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Polyester Resin Composition and Method for Manufacturing Sheetting

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F Terms (Reference): [at end of document]

(54) [Title of the Invention]

**Polyester Resin Composition and Method for
Manufacturing Sheetting**

(57) [Summary]

[Object] To provide a polyester resin composition in which adequate melt tension can be maintained to enable thin and wide sheeting to be released from high-temperature metal rolls, and in which exceptional roll release properties can be achieved at the same time, by means of a process in which a specific resin that allows melt viscosity under heating to be raised and controlled is compounded with a polyester resin composition having a specific amorphous polyester resin as its principal component.

[Means of Achievement] A polyester resin composition characterized in that 1 to 3 weight parts of a lubricant and 1 to 17 weight parts of a modifier comprising a diene rubber or olefin rubber are added per 100 weight parts of a resin component principally comprising an amorphous polyester resin composed of a dicarboxylic acid component consisting of terephthalic acid, and a diol component consisting of 20 to 35 mol% 1,4-cyclohexanedimethanol and 65 to 80 mol% ethylene glycol.

[Claims]

[Claim 1] A polyester resin composition characterized in that 0.5 to 3 weight parts^{*} of a lubricant and 1 to 17 weight parts of a modifier comprising a diene rubber or olefin rubber are added per 100 weight parts of a resin component principally comprising an amorphous polyester resin composed of a dicarboxylic acid component consisting of terephthalic acid, and a diol component consisting of 20 to 35 mol% 1,4-cyclohexanedimethanol and 65 to 80 mol% ethylene glycol.

[Claim 2] A polyester resin composition characterized in that 0.5 to 3 weight parts^{**} of a lubricant, 0.5 to 10 weight parts of an acrylic processing aid, and 0.5 to 17 weight parts of a modifier comprising a diene rubber or olefin rubber are added per 100 weight parts of a resin component principally comprising an amorphous polyester resin composed of a dicarboxylic acid component consisting of terephthalic acid, and a diol component consisting of 20 to 35 mol% 1,4-cyclohexanedimethanol and 65 to 80 mol% ethylene glycol.

[Claim 3] The polyester resin composition according to Claim 1 or 2, characterized in that the resin component comprises 60 to 100 wt% of said amorphous polyester resin and 0 to 40 wt% of another polyester resin.

[Claim 4] The polyester resin composition according to Claim 1 or 2, characterized in that the resin component comprises 80 to 100 wt% of said copolyester resin and 0 to 20 wt% of another polyester resin.

[Claim 5] The polyester resin composition according to Claims 1 to 4, characterized in that the aforementioned polyester resin composition is used for calender molding applications.

^{*} [Translator's note: this weight range is specified as being 1 to 3 weight parts on p. 1 of the original (in "Means of Achievement") and under the Means section in the specification itself.]

^{**} [Translator's note: this weight range is specified as being 1 to 3 weight parts under the Means section in the specification itself.]

[Claim 6] A method for manufacturing polyester resin sheeting, characterized in that the polyester resin composition of Claims 1 to 4 is used in calendering.

[Detailed Description of the Invention]

[0001]

[Technological Field of the Invention] The present invention relates to a polyester resin composition that has adequate melt-processability when employed in calender or extrusion molding, and specifically relates to a polyester resin composition that imparts a melt tension that enables release from high-temperature metal rolls, and simultaneously provides exceptional roll release properties.

[0002]

[Prior Art] Polyester resin sheeting enjoys widespread usage in such applications as surface coverings or wood finishes in furniture, utensils, doors, shelf boards, and the like; decorative sheets for cosmetic surface treatments in light electrical appliance products such as refrigerators and television cabinets; cabinets for use in the office; and packaging material for foodstuffs, medical supplies, and the like. It has generally been the case in the prior art that such polyester resin sheeting is produced by means of molding resin pellets into sheeting as a result of a melt extrusion. However, such extrusion molding processes have involved the use of a T-die to extrude the sheeting to a specific thickness, whereupon the sheeting is worked on a casting roll whose temperature is kept at or below the glass transition temperature. The sheeting is molded at a low speed, resulting in low productivity.

[0003] A drawback occurs when sheeting is manufactured by means of calendering, or when a secondary process such as heat lamination or heat embossing is performed on the resulting sheeting, as the polyester resin tightly adheres to the hot rolls used therein. The use of a fatty acid ester-type lubricant to inhibit adhesion and to enable sheets to be molded by means of calendering is disclosed in Japanese Unexamined Patent Publication (Kokai) 11-343353. Nonetheless, the drawback remains that the melt viscosity does not significantly increase, even with the use of a fatty acid ester lubricant, and therefore the speed of manufacture is reduced, and the thickness of the worked sheeting is restricted to 0.3 mm.

[0004]

[Problems to Be Solved by the Invention] It is an object of the present invention to provide a polyester resin composition in which adequate melt tension can be maintained to enable thin and wide sheeting to be released from high-temperature metal rolls, and in which exceptional roll release properties can be achieved at the same time, by means of a process in which a specific resin that allows melt viscosity under heating to be raised and controlled is compounded with polyester resin composition having a specific amorphous polyester resin as its principal component.

[0005]

[Means Used to Solve the Above-Mentioned Problems] The present invention provides a polyester resin composition characterized in that 1 to 3 weight parts of a lubricant and 1 to 17 weight parts of a modifier comprising a diene rubber or olefin rubber are added per 100 weight parts of a resin component principally comprising an amorphous polyester resin composed of a dicarboxylic acid component consisting of terephthalic acid, and a diol component consisting of 20 to 35 mol% 1,4-cyclohexanedimethanol and 65 to 80 mol% ethylene glycol.

[0006] The present invention moreover provides a polyester resin composition characterized in that 1 to 3 weight parts of a lubricant, 0.5 to 10 weight parts of an acrylic processing aid, and 0.5 to 17 weight parts of a modifier comprising a diene rubber or olefin rubber are added per 100 weight parts of a resin component principally comprising an amorphous polyester resin composed of a dicarboxylic acid component consisting of terephthalic acid, and a diol component consisting of 20 to 35 mol% 1,4-cyclohexanedimethanol and 65 to 80 mol% ethylene glycol.

[0007]

[Embodiments of the Invention] The present invention shall be explained in detail below. The amorphous polyester resin used as a principal component of the resin component of the polyester resin composition of the present invention is composed of a dicarboxylic acid component consisting of terephthalic acid, and a diol component consisting of 20 to 35 mol% 1,4-cyclohexanedimethanol and 65 to 80 mol% ethylene glycol. Specific examples include "PETG 6763" (copolyester in which a dicarboxylic acid component comprising terephthalic acid, and a diol

component comprising 30 mol% 1,4-cyclohexanedimethanol and 70 mol% ethylene glycol, have been copolymerized) and "Provista" (high-melt viscosity copolyester in which a dicarboxylic acid component comprising terephthalic acid, and a diol component comprising 30 mol% 1,4-cyclohexanedimethanol and 70 mol% ethylene glycol, have been copolymerized together with an extremely small quantity of a third component), both of which are manufactured by Eastman Chemical Co. A crystalline, low-crystalline, or another amorphous polyester resin may be compounded with the aforementioned amorphous polyester resin. Specific examples include PET resin, PBT resin, PBTI resin, and PETI resin. The amount of the aforementioned amorphous polyester resin to be compounded with 100 weight parts of the total content of such polyester resins is 60 to 100 weight parts, and preferably 80 to 100 weight parts. If the amount of amorphous polyester resin to be compounded is less than 60 weight parts, the amount of additives necessary to raise the melt viscosity will increase, which is not preferable.

[0008] Diene rubber modifiers to be compounded with the aforementioned polyester resin composition are typically rubber particles of a multilayered structure in which methyl methacrylate, styrene, or another vinyl monomer is graft-polymerized to form a shell component on a core component comprising butadiene-styrene rubber, acrylonitrile-butadiene rubber or other diene rubber polymer; e.g., "Metablen C-201" (Mitsubishi Rayon Co., Ltd.), "Paraloid EXL-2602" (Kureha Chemical Industry Co., Ltd.), and ABS resin manufactured by Technopolymer Co., Ltd. Olefin rubber modifiers are typically rubber particles of a multilayered structure in which methyl methacrylate, styrene, or another vinyl monomer is graft-polymerized to form a shell component on a core component comprising hydrogenated diene-rubber, ethylene-propylene rubber, or another olefinic rubber polymer; e.g., AES resins manufactured by Technopolymer Co., Ltd. and Nippon A&L Inc. Modifiers that comprise diene rubber or olefin rubber are used in a range of 1 to 17 weight parts (or 0.5 to 17 weight parts when used in combination with an acrylic processing aid), and preferably 1.5 to 15 weight parts, per 100 weight parts polyester resin. Compounding these components in the amounts specified by these ranges will impart lubricity to the composition, and will enable the melt viscosity to be increased, thereby making it easier to transport the composition in a heated and gelled state, thereby increasing the precision with which the materials can be fed to the calender rolls in predetermined amounts, improving the precision of sheeting thickness, and allowing sheeting of exceptional smoothness to be manufactured. The aforementioned effects will be unobtainable if

the amount is less than one weight part, while the surface properties of the sheeting will tend to be sacrificed if the amount is in excess of 17 weight parts, which is not preferable.

[0009] Examples of lubricants to be compounded with the aforementioned polyester resin include paraffin wax, olefin wax, and other hydrocarbon lubricants; stearic acid and other higher fatty acid lubricants; calcium stearate and other metallic soap lubricants; and montanic acid wax and other ester lubricants. These lubricants may be used individually or in mixtures of two or more.

[0010] If the lubricant compounding ratio is too small, the compounding effect will disappear, and it will be impossible to prevent the polyester resin from adhering to the calender rolls; on the other hand, if the ratio is too great, excessive blowoff on the sheeting surface will occur, and printability will be sacrificed, resulting in an undesirable end product. Accordingly, the amount of lubricant is specified as being 0.5 to 3 weight parts, and preferably 1 to 2.5 weight parts, per 100 weight parts of the amorphous polyester resin in the present invention,

[0011] The acrylic processing aid to be compounded in the present invention is preferably a copolymer with a weight-average molecular weight of 1,000,000 to 5,000,000, primarily composed of acrylate esters such as acrylic acid, methyl acrylate, ethyl acrylate, *n*-butyl acrylate, isobutyl acrylate, and 2-ethylhexyl acrylate; or methacrylate esters such as methyl methacrylate, ethyl methacrylate, *n*-butyl methacrylate, isobutyl methacrylate, and 2-ethylhexyl methacrylate, with specific examples including "Metablen P-551" and "Metablen P-530A" manufactured by Mitsubishi Rayon Co., Ltd., and "Kane Ace PA30" and "Kane Ace PA-100" manufactured by Kanegafuchi Chemical Industries Co., Ltd.

[0012] Such acrylic processing aids may be compounded in an amount of 0.5 to 10 weight parts, preferably 0.5 to 8 weight parts, and ideally 1 to 6 weight parts, per 100 weight parts polyester resin. Too small a compounding amount will eliminate the lubricity and melt viscosity-increasing effects, and will make it difficult to provide a thin, uniform surface to the end product. Conversely, too great an amount will cause a turbulent flow in the calender roll bank, and will tend to adversely affect the surface properties, which is not preferable.

[0013] A variety of additives that are conventionally compounded; e.g., pigments, hindered amine light stabilizers, UV absorbers, antioxidants, antistatic agents, inorganic and organic fillers, and compatible resins, may also be compounded in the present invention.

[0014] If the aforementioned amorphous polyester resin is used as the principal component, the polyester resin sheeting of the present invention is prepared by means of compounding the resin component, modifier (which comprises either a diene rubber or an olefin rubber), lubricant, acrylic processing aid, and any of the aforementioned additives as required in the respectively specified amounts; kneading the compounded product to produce a starting material; and manufacturing the sheeting by means of common calendering methods. The calender roll temperature is ordinarily set to 160 to 190°C, and preferably 170 to 190°C.

[0015]

[Working Examples] The present invention is described in detail below with reference to working and comparative examples; however, the present invention shall not be construed to be limited to these examples. The categories that were evaluated and the methods used in their evaluation are as described hereunder.

[0016] (1) Calenderability

An apparatus having four calender rolls that were 24 in diameter was used to produce sheeting 1,500 mm in width, and respectively 0.05 mm, 0.07 mm, 0.1 mm, 0.15 mm, 0.2 mm and 0.3 mm in thickness.

- A: Calendered sheeting could be produced at all thicknesses (0.05 mm to 0.3 mm).
- B: Calendered sheeting could be produced at thicknesses from 0.07 mm to 0.3 mm.
- C: Calendered sheeting could be produced at thicknesses from 0.2 mm to 0.3 mm.
- D: Calendered sheeting could be produced at a thickness of 0.3 mm.
- E: Calendered sheeting could not be produced at any thickness.

[0017] (2) Thickness precision

Using the thinnest of the sheeting that had been fabricated under the aforementioned category (1) (calenderability), ten measurements were made every ten meters along the length direction at ten locations along the width direction of the sheeting to determine variations in thickness.

- A: within $\pm 3\%$
- B: within $\pm 7\%$
- C: within $\pm 10\%$

[0018] (3) High-temperature embossing properties

Measurements were taken of the highest temperature on the surface of an embossing roll encountered when an embossing was transfer-molded onto the sheeting using an embossing roll that had 20- μ m-deep projections and depressions and a surface temperature of 110 to 150°C, with at least 80% of the depth able to be maintained in the sheeting surface.

- A: 150°C or higher
- B: 140°C or higher, but less than 150°C
- C: 115°C or higher, but less than 140°C
- D: Less than 115°C

[0019] Working Example 1

2 weight parts of diene rubber modifier ("Metablen C-201"; manufactured by Mitsubishi Rayon Co., Ltd.), 1.5 weight parts of lubricant ("G431L"; montanic acid wax; manufactured by Clariant (Japan) K.K.), 5 weight parts of titanium oxide (an inorganic filler), and 1 weight part of phenolic antioxidant were compounded per 100 weight parts of an amorphous polyester resin ("Provista"; manufactured by Eastman Chemical Co.). A common calendering method was employed to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm at 175°C. The results for the evaluations of calenderability, thickness precision, and suitability for high-temperature embossing are shown in Table 1.

[0020] Working Example 2

5 weight parts of diene rubber modifier ("Metablen C-201"; manufactured by Mitsubishi Rayon Co., Ltd.), 1.5 weight parts of lubricant ("G431L"; montanic acid wax; manufactured by Clariant (Japan) K.K.), 5 weight parts of titanium oxide (an inorganic filler), and 1 weight part of phenolic antioxidant were compounded per 100 weight parts of of an amorphous polyester resin ("PETG 6763"; manufactured by Eastman Chemical Co.). A common calendering method was employed to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm at 180°C. The results for the evaluations of calenderability, thickness precision, and suitability for high-temperature embossing are shown in Table 1.

[0021] Working Example 3

5 weight parts of diene rubber modifier ("Paraloid EXL-2602"; manufactured by Kureha Chemical Industry Co., Ltd.), 1.5 weight parts of lubricant ("G431L"; montanic acid wax; manufactured by Clariant (Japan) K.K.), 5 weight parts of titanium oxide (an inorganic filler),

and 1 weight part of phenolic antioxidant were compounded per 100 weight parts of an amorphous polyester resin ("PETG 6763"; manufactured by Eastman Chemical Co.). A common calendering method was employed to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm at 180°C. The results for the evaluations of calenderability, thickness precision, and suitability for high-temperature embossing are shown in Table 1.

[0022] Working Example 4

5 weight parts of diene rubber modifier (ABS manufactured by Technopolymer Co., Ltd.), 1.5 weight parts of lubricant ("G431L"; montanic acid wax; manufactured by Clariant (Japan) K.K.), 5 weight parts of titanium oxide (an inorganic filler), and 1 weight part of phenolic antioxidant were compounded per 100 weight parts of an amorphous polyester resin ("PETG 6763"; manufactured by Eastman Chemical Co.). A common calendering method was employed to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm at 180°C. The results for the evaluations of calenderability, thickness precision, and suitability for high-temperature embossing are shown in Table 1.

[0023] Working Example 5

5 weight parts of olefin rubber modifier (AES manufactured by Technopolymer Co., Ltd.), 1.5 weight parts of lubricant ("G431L"; montanic acid wax; manufactured by Clariant (Japan) K.K.), 5 weight parts of titanium oxide (an inorganic filler), and 1 weight part of phenolic antioxidant were compounded per 100 weight parts of an amorphous polyester resin ("PETG 6763"; manufactured by Eastman Chemical Co.). A common calendering method was employed to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm at 180°C. The results for the evaluations of calenderability, thickness precision, and suitability for high-temperature embossing are shown in Table 1.

[0024] Working Example 6

5 weight parts of olefin rubber modifier (AES manufactured by Nippon A&L Inc.), 1.5 weight parts of lubricant ("G431L"; montanic acid wax; manufactured by Clariant (Japan) K.K.), 5 weight parts of titanium oxide (an inorganic filler), and 1 weight part of phenolic antioxidant were compounded per 100 weight parts of an amorphous polyester resin ("PETG 6763"; manufactured by Eastman Chemical Co.). A common calendering method was employed to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm at

180°C. The results for the evaluations of calenderability, thickness precision, and suitability for high-temperature embossing are shown in Table 1.

[0025] Working Example 7

5 weight parts of diene rubber modifier ("Metablen C-201"; manufactured by Mitsubishi Rayon Co., Ltd.), 1.5 weight parts of lubricant ("G431L"; montanic acid wax; manufactured by Clariant (Japan) K.K.), 5 weight parts of titanium oxide (an inorganic filler), and 1 weight part of phenolic antioxidant were compounded per 100 weight parts of a polyester resin component comprising 80 weight parts of amorphous polyester resin ("PETG 6763"; manufactured by Eastman Chemical Co.) and 20 weight parts of PETI resin ("GM500"; copolyester resin comprising 30 mol% isophthalic acid and 70 mol% terephthalic acid as the dicarboxylic acid component and diethylene glycol; manufactured by Toyobo Vylon Dept.). A common calendering method was employed to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm at 180°C. The results for the evaluations of calenderability, thickness precision, and suitability for high-temperature embossing are shown in Table 1.

[0026] Working Example 8

5 weight parts of olefin rubber modifier (AES manufactured by Technopolymer Co., Ltd.), 1.5 weight parts of lubricant ("G431L"; montanic acid wax; manufactured by Clariant (Japan) K.K.), 5 weight parts of titanium oxide (an inorganic filler), and 1 weight part of phenolic antioxidant were compounded per 100 weight parts of a polyester resin component comprising 80 weight parts of amorphous polyester resin ("PETG 6763"; manufactured by Eastman Chemical Co.) and 20 weight parts of PETI resin ("GM500"; copolyester resin comprising 30 mol% isophthalic acid and 70 mol% terephthalic acid as the dicarboxylic acid component and diethylene glycol; manufactured by Toyobo Vylon Dept.). A common calendering method was employed to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm at 180°C. The results for the evaluations of calenderability, thickness precision, and suitability for high-temperature embossing are shown in Table 1.

[0027] Working Example 9

5 weight parts of diene rubber modifier ("C-201"; manufactured by Mitsubishi Rayon Co., Ltd.), 1.5 weight parts of acrylic processing aid ("Kane Ace PA-100"; manufactured by Kanegafuchi Chemical Industries Co., Ltd.), 1.5 weight parts of lubricant ("G431L"; montanic acid wax; manufactured by Clariant (Japan) K.K.), 5 weight parts of titanium oxide (an inorganic

filler), and 1 weight part of phenolic antioxidant were compounded per 100 weight parts of an amorphous polyester resin ("PETG 6763"; manufactured by Eastman Chemical Co.). A common calendering method was employed to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm at 180°C. The results for the evaluations of calenderability, thickness precision, and suitability for high-temperature embossing are shown in Table 1.

[0028] Working Example 10

5 weight parts of olefin rubber modifier (AES manufactured by Technopolymer Co., Ltd.), 1.5 weight parts of acrylic processing aid ("Kane Ace PA-100"; manufactured by Kanegafuchi Chemical Industries Co., Ltd.), 1.5 weight parts of lubricant ("G431L"; montanic acid wax; manufactured by Clariant (Japan) K.K.), 5 weight parts of titanium oxide (an inorganic filler), and 1 weight part of phenolic antioxidant were compounded per 100 weight parts of an amorphous polyester resin ("PETG 6763"; manufactured by Eastman Chemical Co.). A common calendering method was employed to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm at 180°C. The results for the evaluations of calenderability, thickness precision, and suitability for high-temperature embossing are shown in Table 1.

[0029] Working Example 11

A diene rubber modifier* ("Metablen C-201"; manufactured by Mitsubishi Rayon Co., Ltd.), 1.5 weight parts of lubricant ("G431L"; montanic acid wax; manufactured by Clariant (Japan) K.K.), 5 weight parts of titanium oxide (an inorganic filler), and 1 weight part of phenolic antioxidant were compounded per 100 weight parts of a polyester resin component comprising 85 weight parts of an amorphous polyester resin ("Provista"; manufactured by Eastman Chemical Co.) and 15 weight parts of a PETI resin ("EFG70"; manufactured by Kanebo Gohsen Ltd.). A common calendering method was employed to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm* at 180°C. The results for the evaluations of calenderability, thickness precision, and suitability for high-temperature embossing are shown in Table 1.

* [Translator's note: no amount has been specified for the modifier in this example.]

* [Translator's note: rendered identically to the original. The thicknesses in all of the other working examples are specified as 0.05 to 0.3 mm. There is presumably a typographical error in the original.]

[0030] Comparative Example 1

1.5 weight parts of lubricant ("G431L"; montanic acid wax; manufactured by Clariant (Japan) K.K.), 5 weight parts of titanium oxide (an inorganic filler), and 1 weight part of phenolic antioxidant were compounded per 100 weight parts of an amorphous polyester resin ("PETG 6763"; manufactured by Eastman Chemical Co.). A common calendering method was employed to attempt to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm at 160°C; however, the production speed was lower than in the working examples, and satisfactory sheeting could be obtained only in the larger thicknesses. The results for the evaluations of calenderability, thickness precision, and suitability for high-temperature embossing are shown in Table 1.

[0031] Comparative Example 2

Attempts were made to manufacture white polyester resin sheeting of thicknesses ranging from 0.05 to 0.3 mm in the same manner as in Comparative Example 1, with the exception that the calendering temperature employed in Comparative Example 1 was set to 175°C. No satisfactory sheeting could be obtained, even at a thickness of 0.3 mm.

[0032]

[Table 1]

Table 1

	Working Examples											Compar. Examples	
	1	2	3	4	5	6	7	8	9	10	11	1	2
Polyester resin - Provista - PET G6763 - PETI* - PBTI**	100	100	100	100	100	100	80 20	80 20	100	100	85 15	100	100
Diene rubber modifier - Metablen C-201 - Paraloid EXL-2602 - ABS (Technopolymer)	2	5	5	5			5		5		5		
Olefin rubber modifier - AES (Technopolymer) - AES (Nippon A&L)					5	5		5		5			
Acrylic processing aid - Kane Ace PA-100									1.5	1.5			
Lubricant - G431L	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Evaluation (1) Calenderability (2) Thickness precision (3) High-temper	B A B	A A B	A A B	A A B	A A B	A A B	B A B	B A B	A A A	A A A	A A B	C B C	E B C

[0033]

[Effect of the Invention] According to the present invention, thin polyester resin sheeting may not only be calendered to thicknesses of 0.05 to 0.2 mm, which has hitherto proven impossible, but may also be calendered at high temperatures. The resulting effects allow manufacturing speed to be increased, and sheeting to be manufactured to an exceptional degree of surface smoothness.

* [Translator's note: the data in the table show values of 20 for PBTI, but for PETI, in Working Examples 7 and 8; however, in the descriptions of the examples that appear earlier in the document, the values of 20 apply to PETI and not to PBTI. The value of 15 is correctly applied in Working Example 11]

** [Translator's note: PBTI does not appear as a component in any of the examples.]

F Terms (Reference): [continued from front page]

4F071 AA12X AA15X AA20X AA22X

AA32 AA33 AA33X AA34X

AA46 AA77 AC09 AE11 BB04

BB06 BC01

4F204 AA24 AG01 FA06 FB02 FF05

FQ26 FQ31

4J002 AE043 BG044 BN062

BN142 BN152 CF051 CF061

EF056 EG036 FD173 FD176

FD204